Actuating device for a parking brake

The invention relates to an actuating device according to the preamble of claim 1 for a parking brake in motor vehicles, comprising a toothed segment which is arranged on a bridge-type support of the vehicle body, a brake-actuating lever which is articulated on the bridge-type support, a coupling unit which tensions a brake cable in accordance with the displacement of the brake-actuating lever, a fixing catch which is articulated on the brake-actuating lever and interacts with the toothed segment, a catch spring for pretensioning the fixing catch in the direction of the toothed segment, and a linkage which can be actuated along the brake-actuating lever.

Actuating devices for parking brakes of motor vehicles are known in practice, in which a fixing catch and a push rod which is articulated thereon interact, by actuation of a push button arranged at the front end of the brake-actuating lever in an axially displaceable manner for releasing the fixing catch. In this known arrangement, the spring acting upon the push rod is at the same time the pretensioned element which brings the fixing catch into engagement with a toothing arranged on the vehicle body. The pretensioning of the spring is, in order to prevent inadvertent release of the button, selected to be substantially higher than required in order to secure the fixing catch against the toothing, but this has the consequence of the engagement and disengagement of the fixing catch proceeding with a significant generation of noise.

EP-A-0 351 131 describes an automatically resetting hand-operated parking brake, in which a single-piece fixing catch for the applied state of the hand brake and a further, single-piece catch for resetting the cable tension are articulated on the same shank on a hand-operated brake lever, the fixing catch being pretensioned by a spring in an engagement position with a toothed

surface of the bridge-type support which is fixed to the vehicle body, and being connected, at its end remote from the toothed surface, to a spring-loaded actuating linkage integrated in the hand-operated brake lever, the actuation of a button on the hand-operated brake lever via the actuating linkage enabling the fixing catch to be disengaged from the toothed surface.

GB-A-2 059 022 describes a foot-operated parking brake which fixes the cable tension of the brake via a foot-operated brake lever, which can be pivoted relative to a bridge-type support fixed to the vehicle body and can be pivoted together with a toothed surface and has a pedal articulated thereon, in that a catch which is articulated on the foot-operated brake lever comes into engagement with the toothed surface for the purpose of locking the tightened brake cable, in which case, in order to actuate the catch toward releasing the engagement, said catch, at its end remote from the toothed surface, is actuated via a lever articulated on this end, the lever, at its end remote from the articulation with respect to the catch, being connected in an articulated manner to a rod mounted on the pedal and furthermore being held by a spring counter to the actuating direction of the pedal in such a manner that the catch can only be brought out of engagement with the toothed surface by means of a tilting movement which takes place simultaneously in the direction of releasing the catch and actuates the rod, and by means of a pedal-pressing movement which takes place in the direction of locking the catch and actuates the foot-operated brake lever.

EP-A-0 771 706 describes a hand-operated parking brake for motor vehicles, in which a fixing catch which is articulated on the brake-actuating lever is of two-part design in such a manner that a restoring movement occurring when slipping it over the toothing can take place at a first catch part decoupled from the second catch part which is articulated on an actuable linkage, while actuation of the linkage via driving lugs can enable the first catch part to be disengaged from the toothing. In this known actuating device, a leg spring is

provided which acts upon the first catch part in the direction of engagement with a toothing fixed on the vehicle body, the solution, all in all, being expensive and awkward with regard to the installation and the multiplicity of parts, in particular the moveable parts.

DE-A-195 38 108 describes a brake device, in which a rack which is connected to a hand-operated brake lever interacts with a catch which is configured as a double lever, for the purpose of locking a brake cable in place, a U-shaped leaf spring being provided on that lever of the catch which faces the rack, the legs of which spring grip laterally around the boundary surfaces of the rack and at the ends produce a frictional force which, during tensioning of the brake, reinforces the force of a spring acting on the other, shorter lever. Furthermore, a rod which is displaced by the movements of the catch engages in an articulated manner on the short lever in order to release the brake. A disadvantage of this parking brake is, in particular, the fact that the U-shaped leaf spring has a tendency to wear, because of the friction produced by it, and so the corresponding braking force changes over the course of time. In addition, impurities or the like may cause the spring to become blocked, which would result in the brake device being put out of operation altogether. Furthermore, the leaf spring causes, in particular, a great multiplicity of parts.

GB-A-1 428 230 describes a servo-assisted, hand-operated parking brake which has servo assistance by means of a hydraulic brake-supporting unit. A catch which is designed as a double lever engages here with its engagement tooth in a toothed segment of an inhibiting wheel, a compression spring acting on that lever of the catch which faces the toothed segment, in order to secure the catch. In order to release the catch, a push rod is actuated, said push rod being integrated in the brake-actuating lever and its front end being held displaceably in a longitudinal guide and its rear end having a slot which permits displacement relevant to the articulated pin, on which the brake-actuating lever is mounted. The rounded, rear end of the push rod is used to actuate an

intermediate double lever whose end which faces the push rod is in contact with the rounded end of the push rod, while a distance remains between that end of the intermediate double lever which faces the catch and that lever of the catch which is remote from the toothed segment, in order to permit a movement of the catch when being latched over the teeth of the toothed segment during application of the brake-actuating lever. Since the compression spring acts on that lever of the catch which faces the toothed segment, said spring is to be configured with a high spring force, as a result of which the latching or braking noise during application of the brake-actuating lever is clearly audible. Moreover, because of the small distance of the lever, which is remote from the toothed segment, from the intermediate lever, there is still the risk of a knocking noise occurring when the two parts mentioned bump together. Finally, the release of the catch is difficult because of the unfavorable lever ratios, and the optimum coordination of the various interacting parts is complicated in terms of installation.

It is the object of the invention to provide an actuating device according to the preamble of claim 1, which, with simple means, enables a good reduction of noise when applying the parking brake.

This object is achieved according to the invention for the actuating device mentioned at the beginning by the characterizing features of claim 1 in that the catch spring is designed as a compression spring and engages on one end, which faces away from the toothed segment, of the fixing catch designed as a single-piece double lever, and that the linkage displaces the locking catch out of engagement with the toothed segment counter to the presentation of the catch spring only in the actuating state.

The actuating device according to the invention reduces the actuating force on the fixing catch, as a result of which the generation of noise when applying the brake-actuating lever can be set as a function of the spring force of the

compression spring and is correspondingly reduced. The noisy engagement of the engagement tooth which, in the case of conventional parking brakes, is experienced disagreeably as an excessively loud indication of the mechanics, is also reduced, with inexpensive components being used for the actuating device, in such a manner that a separate noise insulation is not required. At the same time, it is possible to realize the predefined values for the actuating forces of a push button at the front end of the push rod, which forces for safety reasons, have a minimum height, so that the actuating device according to the invention is advantageously used in particular in hand-operated parking brakes.

The configuration of the actuating device according to the invention has the effect that when pivoting of the single-piece fixing catch, the decoupling from the linkage means that the linkage does not move, as a result of which vibration or a visually perceivable movement of a push button arranged on the end side is prevented, and the overall impression of quiet mechanical properties of the actuating device is imparted to the vehicle driver.

By means of the design of the catch spring as a compression spring the engagement of the fixing catch is at the same time realized in a particularly functionally reliable and cost-effective manner, the installation of the actuating device additionally being made possible by the simple means for placing a compression spring against one end of the housing serving as an abutment for the compression spring. It is also possible to limit the relaxation of the compression spring by a stop for the compression spring or by a stop for the fixing catch, as a result of which, on the one hand, a defined minimum distance can be kept between the end of the linkage, on the one hand, and a stop point of the fixing catch, on the other hand, said minimum distance being available as an idling path during actuation of the linkage.

The fixing catch is expediently provided, on a short lever facing the toothing, with an engagement lug which is not necessarily arranged as an extension of

the lever, but may also be arranged projecting laterally and is intended to come into engagement with the toothing, so that when engaged, the brake-actuating lever is fixed in its applied position at an angle with respect to the relaxed position.

The fixing catch preferably has, on its long lever which faces away from the toothing, a stop point against which the end of the linkage strikes only when actuation has taken place to some extent, in which case, by releasing the actuation, the end of the linkage comes out of contact with the stop point, so that the fixing catch enters into engagement with the toothing only under the influence of the catch spring. By this means, it is particularly advantageously possible to release the parking brake just to some extent and subsequently, by ending the actuation, to enable it to come again into engagement with the toothing without it being required for the hand brake to be guided completely into its starting position and then to be reapplied. There is no longer a form-fitting connection between the linkage and the fixing catch, and so the two associated units in a parking brake can be interchanged independently of each other and, moreover, the installation is simplified.

The stop point is expediently arranged on that side of the long lever of the fixing catch which faces away from the catch spring, so that the spring forces of the catch spring, on the one hand, and of the push-rod spring, on the other hand, are essentially directed in the same direction when the linkage is actuated and can therefore essentially be taken into consideration additively for the design by taking into consideration the sign for the orientation.

The linkage, expediently in the vicinity of the stop point and essentially at the inwardly directed end of the linkage, is preferably equipped in the brake-actuating lever with an axial guide along the brake-actuating lever, with the result that the impacting movement of the linkage in the event of the push button being actuated is guided axially in the direction of the fixing catch,

preferably onto a stop point provided thereon. The guide is preferably formed by a slot which is provided in the region of the end of the linkage and in which a pin engages, the slot preferably being integrated in the linkage and the pin being arranged fixedly on the brake-actuating lever. The longitudinal axis of the slot, which axis essentially coincides with the impacting direction of the linkage, and the main axis of the catch spring are arranged essentially parallel, it being possible for the two axes to be arranged offset laterally from each other. The catch spring will preferably engage on the end of the lever of the fixing catch, so that a relatively long spring excursion is covered for the pivoting of the fixing catch during engagement in the toothing, as a result of which the snapping-in noise turns out to be less pronounced.

The fixing catch can expediently be produced cost-effectively as a sheet-metal pressed part. It is alternatively possible to form the fixing catch as a plastic injection-molded part, as a result of which the noise formed when latching it over the toothing is further reduced.

In addition to the parts provided for applying and releasing the coupling unit, the actuating device expediently also has a resetting device for the coupling unit, which permits resetting of the brake cable, for example if the latter is sagging or elongation has occurred for other reasons, with the result that a number of latching positions of the fixing catch, in which the parking brake does not hold, do not necessarily have to be set initially in order to fix the parking brake. For this purpose, the resetting device preferably comprises a cable pulley which is acted upon in the application direction of the brake cable by a spring load, can be coupled to the brake-actuating lever by means of a circumferential toothing and a driving catch, which is designed as a tilting lever and can be reversed as a function of the application path of the hand-operated brake lever, which cable pulley ensures, by means of the spring load, that the brake cable is in a tightly pulled state in each case when the parking brake is released.

The actuating device according to the invention for a parking brake can be provided in both foot-operated parking brakes and in hand-operated parking brakes.

As an alternative to a decoupled and two-part design of the push rod and fixing catch, it is possible to structurally connect the two parts and thereby to further simplify the installation. To this end, the linkage and the fixing catch can even be designed as a single part. In spite of the single-part design, the displacement of the fixing catch relative to the linkage for the latching movements can be designed, according to the invention, in a manner free from a form-fitting connection, so that the linkage is not carried along during pivoting of the catch when the latter, because of application of the brake-actuating lever, is displaced on the toothed segment. In this case, the force of the catch spring has merely to be overcome, which is associated with little generation of noise. However, the two parts are at least coupled in a form-fitting manner such that when the linkage is displaced counter to the catch spring (and, by actuation of the push button, counter to the further compression spring arranged in the handle) the fixing catch is carried along and, by this means, releases the latching position.

The linkage and the fixing catch are preferably coupled via a slot in one of the two parts and a pin which is arranged in the other of the two parts and engages in the slot, in such a manner that a pivoting movement the fixing catch counter to the pretensioning of the catch spring can be carried out without movement of the linkage. In this connection, the slot can advantageously have a curvature corresponding to the pivoting radius of the pin.

Further advantages and features of the invention emerge from the dependent claims and from the following description.

The invention will be explained in greater detail below using a preferred exemplary embodiment and with reference to the attached drawings.

Fig. 1 shows, in a partially cutaway illustration, an exemplary embodiment of a parking brake according to the invention in a set-down position.

Fig. 2 shows the parking brake from Fig. 1 during application of the brake-actuating lever.

Fig. 3 shows the parking brake from Figs 1 and 2 with the linkage actuated.

The hand brake 1, part of which is illustrated in Fig. 1, has a bridge-type support 2 which is arranged together with the vehicle body for rotation in common and on which a brake-actuating lever 4 is articulated pivotably via a joint 3. The bridge-type support 2 has, over a circular arc section, a circumferential toothing 5 which is arranged on a circular arc segment whose circle center coincides with the joint 3.

A catch 7 is arranged pivotably on the brake-actuating lever 4 via a joint 6 and has a short lever 7a which faces the toothing 5 and a long lever 7b which is remote from the toothing 5. Formed on the front side of the short lever 7a is an engagement lug 8 which is intended to come into engagement with the teeth of the toothing 5, when the hand brake 1 is applied, for the purpose of securing the position of the hand brake 1. When the hand brake 1 is not actuated, the engagement lug 8 rests in a region 9 which is provided at an extension of the toothed segment and is recessed with respect to an engagement position.

Formed on the long lever 7b of the fixing catch 7, on the side facing the supporting support 2, is a projection 10 on which a compression spring 11 designed as a spiral spring engages. The compression spring 11 is mounted in a positionally fixed manner on the brake-actuating lever 4 in a housing-like

holder 12, and prestresses the fixing catch 7 in the engagement direction. A stop point 13 is provided on that side of the long lever 7b which faces away from the extension 10, said stop point projecting with respect to the contour of the lever 7b and having an outer contour suggestive of a semicircle.

The brake-actuating lever 4 furthermore has a linkage 14 which comprises a push rod 15 which is arranged essentially axially within the brake-actuating lever 4 in a manner such that it can be displaced by a spring element (not illustrated) when a push button (not illustrated) which is arranged on the front end of the hand-operated brake lever 4 is actuated. The rear end of the push rod 15 comprises an axial guide 16 which is formed as a slot 17 arranged in the end region of the push rod 15, which slot 17 fits on a pin 18 and thus essentially defines the axial actuating path of the push rod 15. The end surface 19, which delimits the push rod 15 to the rear of the guide 16, has, in the rest position of the fixing catch 7, in which the engagement lug 8 rests in the depositing point 9, a slight gap 20 with respect to the stop 13 of the fixing catch 7.

In order to prevent form-fitting contact of the stop point 13 of the fixing catch 7 with the end side 19 of the push rod 15 and always to have ready a gap 20 which provides a short idling path during actuation of the linkage 14 by overcoming the gap, provision is made for the maximum spring excursion of the spring 11 to be restricted by a stop. This stop can be arranged either in the region of the spring excursion itself or in the region of the fixing catch 7, it likewise being possible to provide a restriction for the excursion by means of the rest region 9 for the short lever 7a.

The manner of operation of the parking brake according to the invention will now be explained in further detail with reference to the different actuating states in Figs 1 to 3.

Starting from the set-down position of the hand brake 1 in Fig. 1, a brake cable (not illustrated), which is coupled directly or indirectly to the brake-actuating lever, is tensioned by raising the brake-actuating lever, as a result of which brake shoes or brake disks which are coupled to the brake cable pass into a stop position, for example against the rims of a wheel of the motor vehicle, and block the latter to such an extent that it is prevented from rolling away independently. The coupling unit with which the brake cable is coupled to the brake-actuating lever can include both a direct transmission of the force and a force-assisting device and in particular is expediently designed to reset automatically to the effect that even as the brake-actuating lever is being applied tension is transmitted to the brake cable. Automatically resetting coupling units of this type are known, and a more detailed discussion of them is therefore not entered into.

As the brake-actuating lever 4 is applied it pivots about the joint 3 in the direction of the arrow 21 and displaces the parts articulated on it, in particular the fixing catch 7, the linkage 14 and the spring 11, relative to the bridge-type support 2 which is fixed on the vehicle body. In this case, a pivoting movement of the fixing catch 7 about the joint 6 takes place as a function of the profile of the circular segment past which the engagement lug 8 of the fixing catch 7 slides, a deflection with respect to the rest position in the region 9 always taking place and accordingly the spring 11 being compressed along the circular segment 5 by the guide on account of the lever action. The spring 11 is dimensioned to be sufficiently powerful that at the end of the pivoting movement 21, however, it presses the fixing catch 7, by the action on the long lever 7b, with the engagement lug 8 into the valley situated correspondingly between two teeth of the toothing 5 and therefore locks the brake-actuating lever 4 in place in an angular position with respect to the bridge-type support 2 and its toothing 5. In Fig. 2, the spring 11 is illustrated in the compressed state and it can be seen that the gap 20 between the end side 19 and the stop point 13 has increased correspondingly. The pretensioning of the spring 11 required

for the locking in place is only slight, and so the noise produced by latching between two teeth of the toothing 5 every time a further tooth is overcome turns out to be extremely damped on account of the low forces which are applied and is not perceived to be annoying. It should be noted here that the long lever 7b in relation to the short lever 7a advantageously assists this property, since the path of displacement of the long lever is transmitted to the short lever for the purpose of engagement with the toothing 5 with relatively small spring force.

In Fig. 3, the push rod is displaced by means of a powerful compression spring, by actuation of the push button arranged on the end side, and is displaced to the rear counter to the force of the compression spring 11 with its end side 19 striking against the stop point 13 and displacing the catch 7 about the joint 6, in such a manner that the pin 18 in the slot 17 is arranged in the vicinity of the front end of the slot 17. On account of this frictional connection between the push rod 15 and fixing catch 7, the engagement lug 8 is disengaged from the toothing 5 (or from the rest position 9 if the push button is actuated with the hand brake 1 set down), and, with the hand brake applied, the hand-operated brake lever can be set down as customary in the prior art. It should be taken into consideration that, by means of the semicircular design of the stop point 13, the end side 19 of the push rod 15 always defines, when touching the stop point 13, a tangent which enables the stop point 13 to slide away over the end side 19 and therefore prevents tilting or jamming. If the push button is released, the push rod 15 passes back into its position illustrated in Fig. 1, and the fixing catch 7, on account of the pretensioning of the spring 11, again comes into a stop position with the circumference of the bridge-type support 2, in the rest position 9 in the set-down position, and with the toothing 5 with the hand brake applied.

The invention has been explained above with reference to an exemplary embodiment in which the slot 17 which is arranged in the push rod 15 can be displaced relative to a pin 18 which is fastened on the brake-actuating lever 4.

In addition to a conceivable kinematic reversal, it is, however, possible also to arrange the pin 18 on the fixing catch 7 in such a manner that a form-fitting connection does not come about between the two parts, rather, the fixing catch 7 is carried along in a frictional manner by the linkage 14 only in the event of actuation.

The invention has been illustrated above with reference to an exemplary embodiment of a parking brake as a hand-operated brake. It has to be understood that it is possible to transfer the principles of the invention to a foot-operated parking brake as well.